

# *Magnolia grandiflora* L.

# Southern Magnolia

Magnoliaceae      Magnolia family

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Southern magnolia (*Magnolia grandiflora*), also called evergreen magnolia, bull-bay, big-laurel, or large-flower magnolia, has large fragrant white flowers and evergreen leaves that make it one of the most splendid of forest trees and a very popular ornamental that has been planted around the world. This moderately fast-growing medium-sized tree

grows best on rich, moist, well-drained soils of the bottoms and low uplands of the Coastal Plains of Southeastern United States. It grows with other hardwoods and is marketed as magnolia lumber along with other magnolia species to make furniture, pallets, and veneer. Wildlife eat the seeds, and florists prize the leathery foliage.

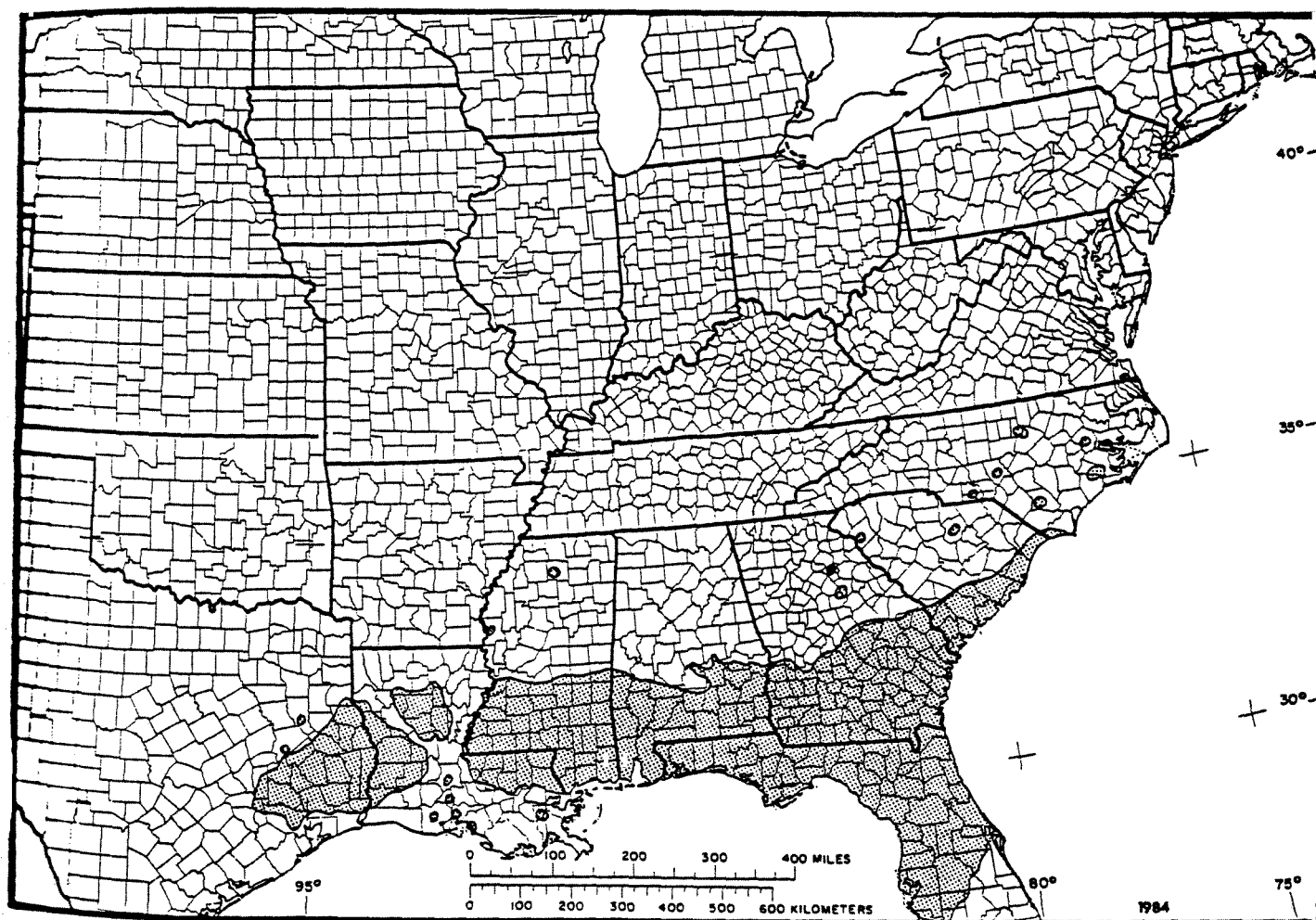


Figure 1—The native range of southern magnolia.

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staminate and pistillate flowers on separate trees (22). Insects, primarily bees, are the major pollinating vector, but pollen is also spread by wind. The fruit, a drupe, changes from green to a dark blue as it ripens, usually in early November in South Carolina.

**Seed Production and Dissemination**—Most years swamp tupelo is a prolific seed producer. Over a 4-year period in a 90-year-old stand in South Carolina seed production was as follows:

Year	Seeds/ha	Seeds/acre
1963	135,900	55,000
1964	0	0
1965	1,697,600	687,000
1966	2,058,400	833,000
Average	972,970	393,750

Seed viability, which averaged 60 percent, increased as the season progressed. The seed crop failure in 1964 was probably the result of a late frost.

In South Carolina seedfall begins in early September (6). About 50 percent of the seeds are shed from late October through November. By early December, seedfall is 90 to 95 percent complete. Dissemination is fairly uniform over an entire area. The principal dissemination agents are gravity and birds, mostly robins. The birds consume the fleshy fruits and the seeds are passed through the digestive tract. In southern Carolina, the arrival of large flocks of migratory robins often coincides with peak ripening. Under these conditions birds can disseminate about 55 percent of the total seed crop. These seeds are evenly distributed and have an average viability of 44 percent. Unlike those of water tupelo, fruits of swamp tupelo do not float.

**Seedling Development**—The seeds normally overwinter and germinate the following spring. Germination is epigeal (22). It does not take place under water, but submerged seeds germinate once the water subsides below the soil surface (7). Germination is rapid in moist, drained conditions at 21° C (70° F) and higher. After germination, seedlings must grow rapidly to keep the apex and leaves above water, because prolonged submergence during active growth will kill them. Submergence during the dormant season, however, has no adverse effect.

Swamp tupelo types are stable and usually regenerate following harvest, although species such as willow (*Salix* spp.) may temporarily dominate some cutover sites (21). Initial seedling establishment is related to seed production, but variation in water table is more important in most years. Environmental conditions under an overstory of 75 to

620 trees per hectare (30 to 250/acre) are favorable for germination and early growth (5). Thus, the shelterwood method can be used to establish seedlings. Regeneration can also be accomplished by clearcutting if it is done following a good seedfall or if, as often happens, advanced reproduction is already established.

**Vegetative Reproduction**—Stump sprouting is very common following logging (4,12,19). Sprouts arise from suppressed buds and are concentrated near the top of the stump. High stumps, the normal condition since trees are usually cut above the butt swell, have many more sprouts than low-cut stumps. Harvesting trees just before the growing season can increase the growth rate of sprouts.

Stump sprouts can produce seed at 2 years of age. Thus, if the seed crop fails or if unfavorable water conditions prevent a good crop of seedlings from becoming established, sprouts can provide a seed source. However, sprout growth is often so rapid and profuse that all competing vegetation, including natural or planted seedlings, is soon overtopped. Whether or not these sprouts develop into good quality stands is not known.

### Sapling and Pole Stages to Maturity

**Growth and Yield**—On good sites swamp tupelo can attain heights of 37 m (120 ft) and diameters exceeding 122 cm (48 in) (2). Average stand d.b.h. at age 85 is 25 cm (10 in) (1). The average height of dominants at different ages is as follows:

Years	Meters	Feet
20	11	36
30	15	50
40	18	59
50	20	65
60	21	70
70	22	73
80	23	76
90	24	78
100	24	80

Pure, even-aged stands produce an average of 9 m<sup>3</sup>/ha (1 cord/acre) per year through age 85. Representative normal yields by age and site index are given in table 1.

**Rooting Habit**—Swamp tupelo normally develops a taproot and has a swollen base to the mean height of the growing season water level. Water roots, which develop under flooded conditions, help support the tree and capture nutrients. These specialized roots tolerate high carbon dioxide concentrations, oxidize



Figure 3—A swamp tupelo in the lower Coastal Plain of South Carolina.

Mississippi Valley to southern Arkansas and west and south Tennessee (17).

### Climate

Swamp tupelo grows in a warm humid climate. Summers are long and hot; winters are short and mild. The frost-free period ranges from 7 months in the northern area to 11 months in the South. Average July temperature is 26° C (78° F). The average January temperature varies from 2° C (35° F) in the North to 18° C (65° F) in the South. Average annual precipitation varies from 1020 to 1650 mm (40 to 65 in) and is lowest at the northern and western edges of the range.

In the Atlantic Coastal Plain, summer usually is wettest and autumn driest. Precipitation is more uniformly distributed along the gulf coast. Periodic summer droughts occur in the western portion of its range.

### Soils and Topography

Swamp tupelo grows on a variety of wet bottom-land soils including organic mucks, heavy clays, and wet sands. It occurs mainly on soils in the orders Ultisols, Inceptisols, and Entisols.

Swamp tupelo not only tolerates flooding but actually thrives under those conditions (16). It is seldom found on sites that are not inundated much of the growing season. Swamp tupelo grows in head-water swamps, strands, ponds, river bottoms, bays, estuaries, and low coves. Normally it does not grow in the deeper parts of swamps or overflow river bottoms.

The type of water regime is more important to growth of swamp tupelo than the soil type (11). Best growth is achieved on sites where the soil is continuously saturated with very shallow moving water. Growth can be reduced as much as 50 percent when the water is stagnant, as in ponds. Intermittent flooding, with periodic drying cycles, or continuous deep flooding even by moving water, also reduces growth.

### Associated Forest Cover

Swamp tupelo is a major component of the forest cover types Baldcypress-Tupelo (Society of American Foresters Type 102), Water Tupelo-Swamp Tupelo (Type 103), and Sweetbay-Swamp Tupelo-Redbay (Type 104) (9). In the following cover types it is a minor component: Cabbage Palmetto (Type 74), Loblolly Pine-Hardwood (Type 82), Slash Pine (Type 84), Slash Pine-Hardwood (Type 85), Atlantic White-Cedar (Type 97), Pond Pine (Type 98), Pondcypress (Type 100), and Baldcypress (Type 101).

Other trees and shrubs commonly associated with swamp tupelo are red maple (*Acer rubrum*), button-bush (*Cephalanthus occidentalis*), buckwheat-tree (*Cliftonia monophylla*), dogwood (*Cornus* spp.), swamp cyrilla (*Cyrilla racemiflora*), swamp-privet (*Forestiera acuminata*), Carolina ash (*Fraxinus caroliniana*), loblolly-bay (*Gordonia lasianthus*), dahoon (*Ilex cassine*), inkberry (*I. glabra*), yaupon (*I. vomitoria*), fetterbush lyonia (*Lyonia lucida*), and bayberry (*Myrica* spp.).

### Life History

#### Reproduction and Early Growth

**Flowering and Fruiting**—The minute greenish-white flowers appear in the spring with the leaves, usually in late April in South Carolina. Flowers are polygamo-dioecious, or swamp tupelo may bear

seminated mostly by birds and mammals, but some may be spread by heavy rains.

**Seedling Development**—Seeds usually germinate the first or second spring following seedfall. Germination is epigeal (19). The best natural seedbed is a rich, moist soil protected by litter. Even though viable, seeds rarely germinate under the parent tree because of reported inhibitory effects (3).

Seedlings are very susceptible to frost damage, and even a light freeze can cause mortality. Partial shade is beneficial for the first 2 years of seedling growth. Under favorable conditions growth is quite rapid. In nurseries, seedlings usually grow 46 to 61 cm (18 to 24 in) the first year (2).

**Vegetative Reproduction**—Mature southern magnolia commonly develops root and stump sprouts (3). Portions of lower limbs of saplings often become imbedded in the forest floor where they develop roots, eventually producing separate trees. Air-layering, stem cuttings, and grafts have all been used to propagate the species for ornamental plantings.

#### Sapling and Pole Stages to Maturity

**Growth and Yield**—On good sites, southern magnolia trees (fig. 2) average 18 to 24 m (60 to 80 ft) tall and 61 to 91 cm (24 to 36 in) in d.b.h. in 80 to 120 years. Heights of 30 to 38 m (100 to 125 ft) have been reported in Florida (2). Annual diameter growth for large mature trees in an east Texas stand was .24 cm (.09 in) (8). In unmanaged natural stands in the Florida panhandle, trees without overtopping competition will average .76 cm (.3 in) of diameter growth and 0.46 m (1.5 ft) of height growth per year through age 50. Under natural conditions, many trees spend 10 to 20 years in the understory before they reach the upper canopy. Annual diameter growth for these trees is .51 cm (.2 in) and average height growth is .31 m (1.0 ft) to age 50 years.

**Rooting Habit**—Southern Magnolia is a deep-rooted species, except on sites with a high water table. Seedlings quickly develop one major taproot. As trees grow the root structure changes. Trees of sapling stage and beyond have a rather extensive heart root system (i.e. several to many sunken roots grow down from the root collar of the tree trunk). Older trees may develop a fluted base with the ridges corresponding to the attachment of major lateral roots.

**Reaction to Competition**—Overall, southern magnolia is tolerant of shade. It can endure consid-



Figure 2—Southern magnolia grown as an ornamental in Florida.

erable shade in early life (8), but needs more light as it becomes older (2). It will invade existing stands and is able to reproduce under a closed canopy (3,8). Once established, it can maintain or increase its presence in stands by sprout and seedling production that grows up through openings, which occur sporadically in the canopy.

Southern magnolia is considered to be one of the major species of the potential climax forest of the southeastern Coastal Plains (3,6,15,16,20). In the past, regular burning restricted the species to the wetter sites, as seedlings are easily killed by fire. Older trees, however, due to bark characteristics, are quite fire resistant (3,10) and even if the tops are killed, they sprout vigorously. Since the advent of improved fire control, southern magnolia has been migrating onto mesic upland sites and establishing itself, along with associated hardwoods, as part of the climax forest.

**Damaging Agents**—Young southern magnolia are susceptible to fire-caused injury and mortality. Winter droughts can cause extensive dieback and mortality. A number of fungi, including species of *Cladosporium*, *Colletotrichum*, *Glomerella*, *Phyllosticta*, and *Septoria* cause leaf spots but these seldom result in any significant damage (2). A leaf spot caused by *Mycosphaerella milleri* can be a problem on nursery seedlings. A number of *Fomes* and *Polyporus* fungi can cause heartrot in southern magnolia. Heavy infestations of magnolia scale (*Neolecanium cornuparyum*) can kill branches or entire trees (18). Oleander pit scale (*Asterolecanium pustulans*) and tuliptree scale (*Toumeyella liriodendri*) attack and injure southern magnolia, but rarely cause mortality (1). A variety of other pests, including tuliptree aphid (*Illinoia liriodendri*), striped mealybug (*Ferrisia virgata*), leaf weevil (*Odontopus calceatus*), magnolia leafminer (*Phyllocnistis magnoliella*), and spider mite (*Tetranychus magnoliae*) feed on this species (18). *Euzophera magnolialis*, a wood borer, can injure or kill nursery seedlings.

## Special Uses

Because of its showy flowers and lustrous evergreen foliage, southern magnolia is a valuable and extensively planted ornamental. In many urban areas where other species do poorly, this magnolia can grow because of its resistance to damage by sulfur dioxide. The seeds are eaten by squirrels, opossums, quail, and turkey (9). The leaves, fruits, bark, and wood yield a variety of extracts with potential applications as pharmaceuticals (4,5).

## Genetics

No work has been done to characterize individual populations. Extensive breeding has been done to develop races of southern magnolia for ornamental use (13). Common varieties include *Magnolia grandiflora lanceolata* with a narrow pyramidal habit and *M. grandiflora gallissoniensis*, reported to be cold hardy (17).

Southern magnolia has been hybridized with sweetbay (*Magnolia virginiana*) and *M. guatemalensis*.

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